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First record of *Camarops petersii* from eastern Europe

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Abstract—The stromatic ascomycete *Camarops petersii* was recorded for the first time in Eastern Europe. It was found growing on *Quercus robur* wood, on a fallen trunk of a lightning stuck tree in Bryansk Oblast, next to the western border of Russia. The morphological description, data on the distribution and habitat are provided. The modern distribution of *C. petersii* is confined mostly to the refugia of tertiary relict floras. All known European populations of *Camarops petersii* (including our own) are from north of the Alps, possibly established relatively recently due to post-glacial colonization of the broadleaf forests. Future *C. petersii* populations may be found in the Mediterranean area and the Caucasus.

Key words—*Boliniaceae*, *Boliniales*, fungal ecology, mycogeography, *Sordariomycetes*

Introduction

Camarops P. Karst. (*Boliniaceae*, *Boliniales*) is a genus of stromatic *Sordiariomycetes* characterized by massive, erumpent, usually dark colored and carbonized stromata, evanescent paraphyses and asci, and relatively small, brown-colored, non-septate ascospores with a germ pore (Nannfeldt 1972). The genus includes 25 species according to Index Fungorum (2019).

Camarops petersii is well distinguished from all other species of the genus because the immature stroma is covered by a thick, membranaceous veil-like structure that breaks down later except at the margin. The species was originally described based on two collections from Alabama, (USA) and Cuba (Berkeley 1868) and for a long time was believed to occur only in the western hemisphere until it was discovered in Korea in 1930 (Iwade 1944) and later in Germany (Nuss & Hilber 1977).

In the present paper, we discuss the first record of *Camarops petersii* in eastern Europe based on a collection made by the second author during a survey of wood-inhabiting fungi in Bryansk Oblast (Russia).

Material & methods

The field survey was organized by the second author in August 2018 during a multi-year survey of the wood-inhabiting fungi of the Non-Chernozem Zone of Russia (Popov 2013, Volobuev 2013, Popov & Volobuev 2014). Voucher specimens were deposited in the Mycological Herbarium of the Komarov Botanical Institute of the Russian Academy of Sciences, Saint Petersburg, Russia (LE).

Global distribution data for *Camarops petersii* was taken from literature and the Global Biodiversity Information Facility portal (GBIF 2019), which cited 112 occurrences on 7 April 2019.

The description of macroscopic characters was based on fresh and dry material and photographs in situ. Microscopic features were observed and measured from dried material squash mounted in tap water for light microscopy (Zeiss Axio Imager A1 microscope). Melzer's reagent (MLZ) was used to check the amyloid reaction of hymenial structures. Dimensions of spores were derived from 20 measures. The images of microstructures were captured with an AxioCam MRc 5 digital camera on the microscope equipped with bright-field and differential interference contrast (DIC) optics. Images were edited by using AxioVision SE64 ver. 4.9.1 software.

DNA extraction, amplification, and sequencing followed Zmitrovich & al. (2019). The fungal specific primers ITS1F and ITS4 were used to sequence the ITS rDNA gene region (White & al. 1990, Gardes & Bruns 1993).

Taxonomy

Camarops petersii (Berk. & M.A. Curtis) Nannf.,
Svensk Bot. Tidskr. 66(4): 366 (1972). Pl. 1

Stromata superficial on wood, individual, 3–5 cm in diam, ≤1 cm high, flattened-turbinate to discoid, centrally attached, woody, dull brown in cross section, initially wrapped in a whitish, brown flecked veil, which irregularly cracks and breaks down when mature to expose a black and shiny stromatal surface; perithecia immersed in the upper part of stromata at different depth (polystichous), obclavate, 1–1.5 × 0.4–0.5 mm, with long necks ending in papillate ostioles.

Asci 52–65 × 4.8–6.3 µm, cylindrical, stipitate, with an inamyloid apical ring, 8-spored, evanescent and often absent in fully mature perithecia; ascospores 6.0–8.4 × 3.3–4.5 µm, uniseriate, 1-celled, ellipsoid to obovate, slightly pointed at one end, olive brown, with two large lipid drops and a germ pore at the

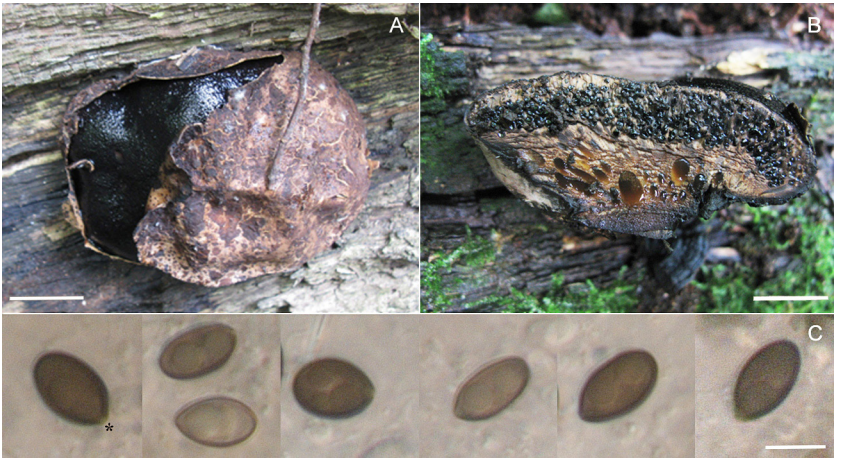

Plate 1. *Camarops petersii* (LE 323478). A. Fresh mature stroma *in situ* showing disrupted veil and exposed stromatal surface; B. Stroma in cross section with polystichous perithecia in upper part; C. Ascospores (position of germ pore marked with an asterisk). Scale bars: A, B = 1 cm; C = 5 µm.

tapered end; paraphyses cylindrical, 1.5–2 µm diam., hyaline, septate, longer than asci and evanescent.

Material examined: **RUSSIA**, **Bryansk oblast**: **Suzemskiy district**, Nerusso-Sevnyi protected forest area, 'Rybnitsa' natural boundary, 52°24′32″N 34°05′00″E, floodplain, oak-dominated deciduous forest with *Quercus robur*, *Acer platanoides*, *Fraxinus excelsior*, on decorticated trunk of *Q. robur* lying on the ground, 30 August 2018, coll. S. Volobuev (LE 323478; GenBank MN564897).

Discussion

Camarops petersii grows on fallen and usually decorticated logs of *Quercus* spp, more rarely of *Castanea*, *Castanopsis*, and *Zelkova* (Nannfeldt 1972, Nuss & Hilber 1977, Doi & Nunomura 1980). Our collection was also found on wood of a barkless, recently fallen trunk that was about 60 cm in diam, and comparatively hard (a knife could not penetrate more than 2–3 cm in depth).

Camarops petersii appears to be widely distributed in North America, where it has been frequently reported from broadleaf forests of the Appalachians and Central Lowlands west to Kansas and as far north as Vermont and Wisconsin (Ellis & Everhart 1888, Shear 1923, Heagle & French 1972, Nannfeldt 1972, Fergus 1973, Horn 1984, Vasilyeva & al. 2007). Moreover, 77 of 112 occurrences of this species in the GBIF portal are from North America (GBIF 2019).

Infrequent findings have been reported from temperate broadleaf and mixed forests in Asia: South Korea (Iwade 1944), Russian Far East (Nannfeldt 1972), Japan (Doi & Nunomura 1980), Taiwan (GBIF 2019), northern Iran (Arefipoor & al. 2018), and northwestern Himalayas (Dargan 1976; Dargan & Thind 1984); and in Europe, from Germany, Austria, and France (Nuss & Hilber 1977, Urban 2016, MycoDB 2019). The modern disjunct distribution of *C. petersii* is thus confined mostly to the refugia of tertiary relict floras as defined by Milne & Abbott (2002).

In Europe, during most of the last glacial period, the temperate forest species, including summer-green species of the *Quercus*, were restricted to small refugia. Those were situated mostly south of 45°N along the Mediterranean coast and around the Black and Caspian Seas (Leroy & Arpe 2007, Svenning & al. 2008, Tzedakis & al. 2013). At that time, most of the area north of the Alps was covered with tundra and cold steppes (Gerasimov & Velichko 1982, Binney & al. 2017). The spread of deciduous *Quercus* species from these refugia to the Central European mountains took place in the late-glacial interstadial (13–11 thousand years ago), and oaks spread into Northern and Eastern Europe only in the Holocene (Brewer & al. 2002, Birks & Tinner 2016). It is likely that European populations of *Camarops petersii* were recently established as a result of post-glacial colonization of the broadleaf forests. We suppose that *C. petersii* still could be found in the Mediterranean area and the Caucasus. But this supposition needs to be verified by mycologists in those regions.

A BLAST search revealed that the ITS sequence newly generated from our material (GenBank MN564897) is identical with those of the North American collection of *C. petersii* MICH 340497 (GenBank MT913624).

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